

Comparison between the experimentally determined orientation dependence of the near edge structure in electron energy loss spectra from graphite with present theoretical formulations

Scientific Achievement

New measurements using high angular resolution electron channeling electron spectroscopy (HARECES) from the graphite K edge are mined to compare to theoretical predictions of the variation in the Energy Loss Near Edge Structure (ELNES) with orientation. The comparisons indicate that the present theoretical formulations are lacking. The work demonstrates that HARECES data provides a versatile and continuous data set that may be used for the close comparison with theory required to refine an understanding of the effect.

Significance

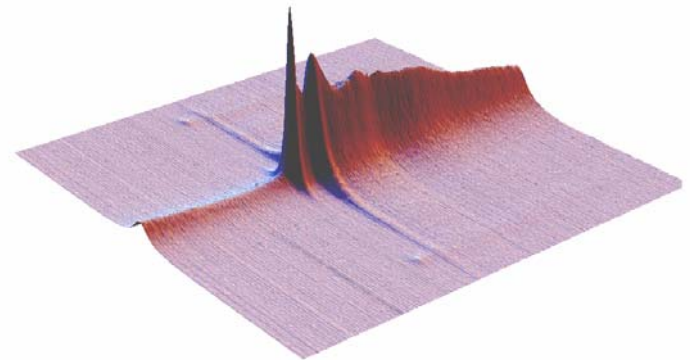
The refinement of present theories describing the orientation dependence of the ELNES of the K edge from graphite will enable vast improvements in the chemical fingerprinting of amorphous carbon compounds with Electron Energy Loss Spectroscopy (EELS). EELS in the Transmission Electron Microscope (TEM) is the technique of choice for the chemical fingerprinting of amorphous carbon compounds with high spatial resolution. In this process crystalline graphite is generally used as the sp^2 standard. However, the ELNES from graphite is highly orientation dependent, making its comparison with amorphous materials fraught. Many works prescribe a set of experimental conditions that minimise the orientation dependence ie the “magic angle”. Not only does this throw away valuable resolution, but there are many discrepancies both between theories, and between experiments. The close comparison between experiment and theory permitted by HARECES data will allow competing theories to be distinguished..

Performers

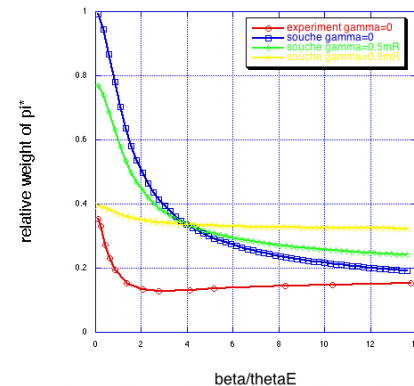
Amelia Liu and Nestor Zaluzec. (ANL-MSD)

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- New measurements using high angular resolution electron channeling electron spectroscopy (HARECES) from the graphite K edge are compared to theoretical predictions of the variation in the Energy Loss Near Edge Structure (ELNES) with orientation.
- Present theoretical formulations require refinement. Vast improvements to the chemical fingerprinting of amorphous carbon materials can be made.



HARECES energy loss surface



Experiment and theory